Cardiothoracic training in the United Kingdom

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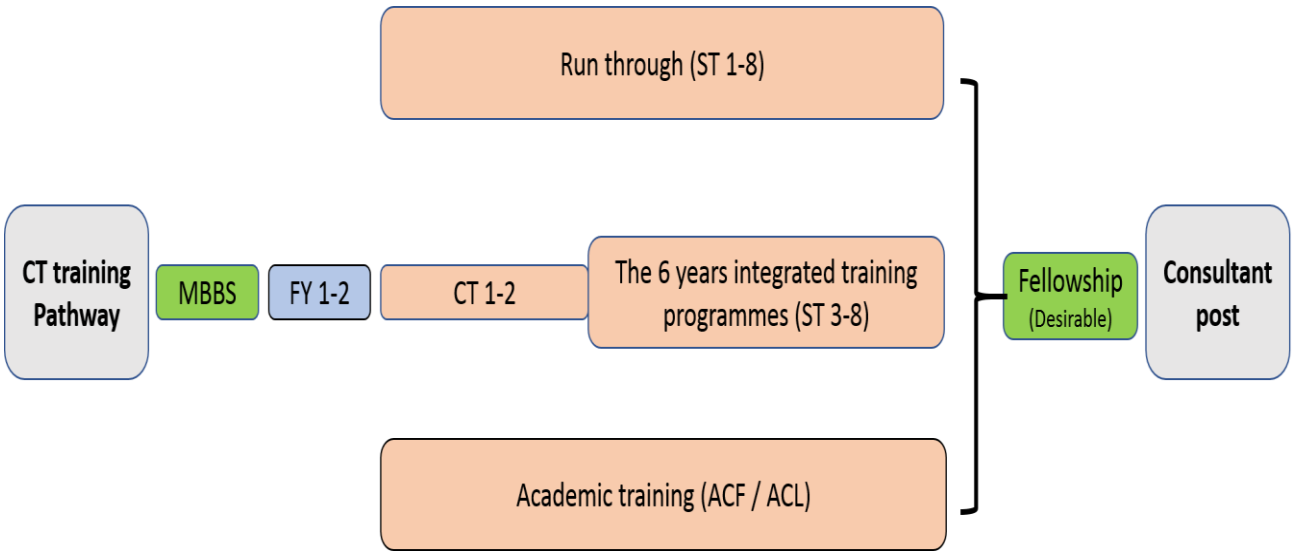
Central picture:



Central message:

CT training in the UK is popular, competitive and capable of producing world class surgeons. The training programme spread over a period of at least 6 years involves regular competence-based assessments and multiple examinations.

1. INTORDUCTION

1.1. History of Cardiothoracic surgery in the UK

In the nineteenth century the accepted wisdom was that “no man who wishes to retain the respect of his colleagues would dare attempt a suturing of the heart”. This concept was challenged by many such as Axel Hermansen Cappelen then Ludwig Rehn in Germany who successfully sutured an actively bleeding wound in the right ventricle of a patient who had been stabbed and cardiac surgery was born (1,2).

The UK was one of the leading countries in the world where significant advancements in cardiothoracic surgery (CT) were made. Henry Souttar, in 1925, successfully operated on a young patient with mitral valve disease at the Middlesex Hospital making it the first successful operation anywhere in the world on a patient’s heart valve. However, despite technological developments in the field of cardiopulmonary bypass the 1930s and 1940s in the USA, the focus in the UK was mainly on thoracic surgery dealing with tuberculosis and its complications.

Russell Brock who worked at The Royal Brompton Hospital and Guy’s Hospital was one of the pioneers who led the way in cardiac surgical innovation and promoted operations to open the pulmonary valve in patients with pulmonary valve stenosis. He was also one of the first surgeons in his field to record surgical outcomes methodically. The 1950s saw rapid expansion of procedures to deal with congenital or valvular heart diseases in the UK which were mainly palliative with relatively high mortality and morbidity.

The 1960-1980s, the era of coronary artery surgery and the first heart transplant, saw the UK establishing a first-class reputation in the cardiac surgery accredited to pioneers such as Donald Ross at Guy’s Hospital and the National Heart Hospital, Terence English at Papworth and Magdi Yacoub at Harefield Hospital.

Initially, CT was highly centralised in London, although this started to change at the end of 1970s as newer regional UK centres were established that provided excellent opportunities for training as well as for clinical work and research.

1.2. The Society for Cardiothoracic Surgery in Great Britain & Ireland

The Society for Cardiothoracic Surgery in Great Britain & Ireland (SCTS) was founded in 1934 and was initially devoted to the practice of thoracic surgery. After World War II, with such pioneers as Lord Brock and Sir Thomas Holmes-Sellors, cardiac surgery was introduced and the number of cardiothoracic surgeons steadily increased. The SCTS as an independent self-funded organization is the representative body for CT in Great Britain and Ireland aiming to improve the quality of care provided to patients, guides the direction of education and development of surgeons in training and supports education and professional development.

SCTS has pioneered data collection and analysis in CT. Many Western countries and in more recent years other surgical specialties have followed this practice. SCTS founded the Cardiac Surgical Register in 1977, as a national record of all cardiac surgical procedures with in-hospital mortality. The Thoracic Surgery Register commenced in 1980. The current UK adult cardiac surgical database collects includes information about the patient's demographics, preoperative clinical characteristics, type of operation, and post-operative outcomes, mainly mortality and more recently major complications such as stroke. This data is collected as unit-specific and surgeon-specific information and is submitted by each unit to National Institute of Cardiovascular Outcome Research (NICOR). The data is analysed annually and published in 3-year periods of activity. It is available on SCTS website (3).

According to the database, there are more than 34,000 cardiac operations performed per year in different centers around the UK (figure 1) with excellent overall survival rates and

continuously diminishing operative mortality despite an increase in the patients' risk profiles (figure 2) (3).

1.3. The Royal Colleges of Surgeons

There are four different Royal Colleges of Surgeons (RCS) in the UK which work in collaboration and are committed to enabling surgeons to achieve and maintain the highest standards of surgical practice and patient care.

Historically, each college heldchoose to membership examinations (MRCS) independently. This changed in 2004 with the emergence of a unified syllabus and examination known as the Intercollegiate MRCS.

There are currently ten surgical specialities including CT which a trainee can specialise in after completing their basic surgical training. The responsibility for setting the standards for surgery rests with the General Medical Council (GMC) and these are actioned by the RCSs which operate through the Joint Committee of Surgical Training (JCST) and its Specialty Advisory Committees (SACs) and Core Surgical Training Committees (CSTCs). Postgraduate Medical Deaneries and/or Local Education and Training Boards (LETBs) and their Schools of Surgery are responsible for running training programmes, which are approved by the GMC and work with the SACs in the recruitment and selection to all levels of pre-Certification training. In the Republic of Ireland, these roles are undertaken by the RCS Ireland and Medical Council of Ireland (MCoI).

CT training in the UK is a broad specialty and includes general and specialised adult cardiac surgery, adult thoracic surgery and congenital cardiac surgery. The latter sub-specialty cares for both children and adults who require surgery for congenital heart defects.

2. OVERVIEW OF CARDIOTHORACIC SURGICAL TRAINING IN THE UK

Training in surgery involves core training (CT) and specialty training (ST). Core surgical training CT1-2 lasts two years and provides training in a range of surgical specialties which can include 6-12 months in CT surgery. It is expected that the trainee will pass the MRCS during the first two years of training before entering speciality training (ST3-8). Towards the end of this training, completion of an exit examination leading to specialty fellowship of the Royal College of Surgeons is required, the Intercollegiate FRCS(CTh). After the completion of training, trainees who apply for a consultant post in the UK require a Certificate of Completion of Training (CCT) (or an equivalent certificate of eligibility for specialist registration) in order to be appointed. In addition to core training, as described below there is the option of run through training where trainees who are certain of their specialty choice can compete for entry into the speciality as ST1-2 and continue until certification.

2.1. Training centres

The training centres are accredited by the GMC with advice as to their suitability for this provided by the SAC. There are recognised criteria for a centre to be suitable for training. The number of recognised training posts in each centre or region is determined by a combination of workforce planning and capacity for training within each training region. This is approved by Health Education England and the Regional (Deanery) Schools of Surgery in conjunction with the SAC.

2.2. Selection into cardiothoracic surgery training

In the UK, the 6-year programme (ST3-ST8) was introduced in nine surgical specialties in 2008, whereby candidates are chosen through National Selection. The SAC is responsible for developing person specifications for selection into the speciality (4). Selection takes place

within a national process overseen by the SAC and in the Republic of Ireland, by the RCSI. Entry into the speciality is by competition with well-defined criteria and candidate specification. The general person specification for candidates includes the ability to provide evidence of career progression and present level of achievement and performance which is appropriate with the totality of their period of training. Candidate must also have satisfactorily completed an approved Core Surgical Training programme (CT1-CT2) or equivalent as well as the relevant competencies in CT as described in the Core Surgical Training curriculum. In 2013 entry into run-through training from the ST1 level commenced.

Following short-listing from a detailed written application, candidates are invited to a selection centre for interview. The process of National Selection takes place over two days with approximately 40 consultant CT surgeons as assessors. The interview process is multi-step and includes assessment of the candidates' portfolio, structured interviews, dexterity assessments using objective structured assessment of technical skills (OSATS) and interview scenarios with patients (real patients are not invited, only actors) which includes consenting of patients.

The number of trainees accepted every year is approximately 15-20 including both entry at ST1 and ST3 levels, although the proportion of candidates applying for ST1 positions is increasing and ST3 decreasing. Candidates are ranked and then matched to their desired place for training. The successful candidates are offered a National Training Number (NTN) in a particular region where they rotate between different centres.

It is expected that all trainees will spend time being trained in both cardiac and thoracic surgery and reach a certain competency regardless of what sub speciality they choose after

qualification. A cardiac themed trainee will spend one year in thoracic surgery and a thoracic trainee will spend a year in cardiac surgery.

Training schemes can be divided into:

- *Uncoupled training with entry at ST3*

This has been the most common pathway for entry into CT specialist training in the UK. It involves completion of years 1 and 2 in Core Training when trainees attain common surgical knowledge and skills as well as generic professional behaviours, and is followed by competitive entry into CT training at the ST3 level.

- *Run through training with entry at ST1*

In this scheme, competitive and direct entry into specialist training at ST1 level is possible with run through training to CCT at ST8.

The main advantage of run through training is job security and potentially time saved in total years of training as well as more overall experience in CT surgery. However, there is a potential disadvantage in CT surgeons being less experienced in the generality of surgery. This has been recognised in USA with ineligibility for American Board of Surgery certification, and the lack of a "chief year" experience in general surgery.

- *Academic training*

Some trainees choose to spend a dedicated period of time in research and obtaining a higher postgraduate degree. Thus, different Deaneries offer the option of combined clinical and academic training. Appointment into academic training is usually carried out during the National Selection interviews. Candidates applying for academic training posts will have

additional interviews during the selection process where they are required to demonstrate an understanding of basic research principles, methodology and ethics, and evidence of relevant academic and research achievements.

3. THE CURRICULUM

The curriculum aims for high quality, safe care of surgical patients, specifying the parameters of knowledge, clinical skills, technical skills, professional behaviour and leadership skills that are considered necessary to ensure patient safety throughout the training process.

There are specific conditions that trainees are required to satisfy before being awarded CCT. The JCST has recently issued detailed guidelines (5) which are shown in Table 1. The table includes the number of operations performed which is agreed as 250 major cases The JCST also provides a clear definition to what counts as a major cardiac or thoracic case (Table 2).

4. THE TRAINING EXPERIENCE

There are specific milestones which allow trainees to benchmark their progress which are the entry to surgical training (CT1 or ST1), entry to specialised training (ST3) and exit at CCT.

During early training stages, trainees gain proficiency in conduit harvesting before moving on to the common components of cardiac surgery which include median sternotomy, internal thoracic artery harvesting, cannulation for bypass and sternal closure. During this period, trainees are either assisted by the supervising consultant or more senior trainee but as they progress they will be allowed to perform parts of operations independently. Most of the times the trainees will have to demonstrate proficiency in setting up and finishing cases before they are trained in performing the main parts of the operation under supervision. By the end of

their training they are expected to be able to perform some operations independently. Similar patterns of training are seen in thoracic surgery.

At the end of training, it is expected that trainees will be able to manage some key conditions independently. They are encouraged to arrange a fellowship in another training institution and/or gain an out of programme experience in an area of the specialty that particularly interests them. Many opt to go abroad. The SCTS is among a number of organisations that fund travel bursaries for trainees.

All trainees in CT Surgery are required to be actively involved in the daily management of their patients under the supervision of their clinical supervisor. Moreover, they should have the opportunity to attend a minimum of one consultant supervised outpatient clinic (where they should see both new and follow-up patients) as well as one Multi-Disciplinary Team (MDT) meeting each week.

The UK have demonstrated that it is feasible to train junior doctors in different aspects of conventional and complex cardiac surgery such as beating heart CABG and minimally invasive valve surgery with excellent outcomes which is a reflection of the dedication of UK surgeons to train and improve patient care (6-8).

During their training programme, surgical trainees are required to attend certain courses including Advanced Life Support (ALS), Advanced Trauma Life Support (ATLS), Basic Surgical Skills (BSS) and Care of the Critically Ill Surgical Patient (CCrISP). In addition SCTS Education runs a comprehensive portfolio of courses for the trainees spanning all 6 years of speciality training.

Trainees are actively encouraged to attend and contribute to surgical meetings such as the SCTS annual meeting and European Association for Cardiothoracic Surgery (EACTS) the expenses for which will be usually funded by their local Deaneries.

There has recently been more emphasis on the importance of simulation training. Although it is not widely adopted, there is emerging evidence from the speciality itself in the UK which has shown that simulation is associated with improvement of the trainees understanding and confidence (9-10).

5. TRAINEE ASSESSMENT

The trainees are continuously assessed through Work Based Assessments (WBAs) and structured reports from assigned educational supervisors which in turn contribute to the Annula Review of Competence Progression (ARCP). This assesses the professional requirements expected of all doctors including surgeons to meet their obligations under Good Medical Practice (GMP) in order to remain licensed to practice. The trainee will become competent in managing patients presenting either acutely or electively with a range of symptoms and conditions. This is tested either by the WBAs and also the FRCS(CTh) examination. The final stage of the syllabus is intended to allow the CCT holder to develop a particular area of clinical interest and expertise prior to appointment to a consultant post.

WBAs are the method by which UK trainees are assessed throughout the training programme. They are online tools that requires data input by both the trainee and the trainer. WBAs comprise four different categories of assessments which are:

1- Clinical Evaluation Exercise (CEX): This mainly assesses the way the trainee interacts with patients in term of attitudes, behaviours and skills.

2- Case Based Discussion (CBD): This is a structured, in-depth discussion between the trainee and the trainee's assessor about how a clinical case was managed.

3- Procedure Based Assessment (PBA): assesses the trainee's technical, operative and professional skills in a range of specialty procedures or parts of procedures during routine surgical practice up to the level of certification.

4- Direct Observation of Procedural Skills (DOPS): this is used to assess the trainee's technical, operative and professional skills in a range of basic diagnostic and interventional procedures, or parts of procedures, during routine surgical practice in order to facilitate developmental feedback and it is about the ability of the trainee to carry out a simple procedure (i.e. central catheter insertion).

The PBA is the most thorough WBA and consists of a list of objectives with three possible outcomes alongside each. These outcomes are "not observed or not appropriate," "development required" or "satisfactory standard for certification of completion of training (CCT) (no prompting or intervention required)". There is then an overall score for the procedure.

6. CHALLENGES

CT training in the UK faces a number of challenges and the training organisations such as the SAC working closely with the SCTS aim to regularly refine the curriculum to overcome these challenges and provide support for the trainees. Some of the challenges include:

6.1. Workforce planning and the changes in surgical profile

There is limited number of consultant post available annually in the UK and may not match the number of trainees who are reaching the final stages of training. This has been addressed

by predicting retirement numbers combined with the knowledge of technological development and the public health issues that are affecting the specialty thus being able to provide an estimate of demand for CT surgeons in the future and match it to training places. The speciality is continuing to move towards complete separation between cardiac and thoracic surgery at the level of entry into consultant grade. However, the trainees will for the foreseeable future continue to be trained in both, although they are encouraged to express an interest for one or the other sub-specialty during their training years. Despite the optimistic views of the NHS workforce review, there are concerns surrounding the reduction in the number of cardiac operations carried out yearly which can impact potential for training. Furthermore, the reciprocity of medical training recognised within the European Union (EU) means that CT trainees from other countries in the EU can compete for the limited number of CT consultant posts available in the UK. This can result in local trainees failing to secure consultants posts after finishing their training. Nevertheless although there is no specific priority for UK trainees, working for many years within the NHS confers significant advantages over trainees from other European countries when applying for NHS CT consultant posts.

Another challenge for trainees is that recognised scope of the speciality of CT in the UK is cardiothoracic rather than cardiovascular as in the EU. As a result managing complex aortic pathologies (which depends on the interaction between cardiac surgeons, vascular surgeons and interventional radiologists) is an area of practice for which UK trainees may have less exposure, than those trained in other European countries.

6.2. The publication of surgeon specific data

It is accepted throughout all healthcare organisations that there should be full transparency and disclosure of outcomes, so that patients are provided with clear information on the

performance of hospitals and the surgeons employed there. The basic tenet of this philosophy this that publication of outcomes improves the quality of care that patients receive. A potential disadvantage is that publication of such data may result in risk-averse behaviour by surgeons thus denying many high-risk patients surgical intervention, despite these interventions being the only hope for the patient surviving their disease. Also the publication of surgeon-specific rather than hospital-specific outcomes may lead to an underestimate of the importance of the multi-disciplinary care patients receive throughout their hospital stay.

It is possible that the publication of surgeon specific data may have adversely impacted recruitment to CT, a reduction in training opportunities, as well as leading to a decrease in both the proportion and variety of cases performed by trainees (11, 12).

6.3. The impact of the European Working Time Directive (EWTD)

Most UK surgical trainees and trainers believe that training has suffered due to the introduction of EWTD. EWTD was introduced originally in 1993 to avoid fatigue from over-work. It initially excluded doctors, but revisions by the European Commission in 2000 required doctors-in-training employed by the NHS to comply with a 48 hour week by 2009. This is in stark contrast to the 80 hours per week limit in the United States for medical trainees. The decrease in working hours has resulted in decreased both elective and emergency operative experience (13,14). This is important when taking into account that most CT emergencies which require expert and precise treatment to ensure optimum results tend to occur out of hours. It is therefore likely that EWTD reduces out of hours experience. The EWTD has led to a significant move from on-call to shift-based rotas which are unpopular amongst trainees as it may reduce both the quantity and quality of their training due to the fact that a shift system usually means that the time spent with their dedicated trainer becomes fragmented. There is also reduced continuity of care for patients (15,16).

Furthermore, the limited working hours and the necessity for a shift work pattern have resulted in fewer core surgical trainees rotating to CT. Therefore, with fewer junior trainees exposed to CT, this has resulted in fewer candidates applying for CT programmes in the UK in recent years.

7. CONCLUSIONS

CT training in the UK remains popular, competitive and capable of producing world class surgeons. Training involves regular competence-based assessments and multiple examinations. The higher specialty training programme spread over a period of at least 6 years during which trainees rotate to different centers and get appropriate exposure and training in different cardiac and thoracic conditions. Trainees are supported to choose a sub-specialty during the last two years of their programme. The curriculum continues to evolve to provide trainees with evidence based up-to-date training allowing for integration with other specialities such as cardiology and vascular surgery. There are several challenges facing CT surgery in the UK including the need for continuous evolvement of the curriculum and the ability to provide more structured sub-speciality training in lesser number of years accommodating the working time directives.

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Figures legends:

1- Figure. 1. Number of all cardiac operations in the UK (re-produced with permission from NICOR)

2- Figure. 2. Overall mortality after cardiac operations in the UK (re-produced with permission from NICOR)

Figure. 1

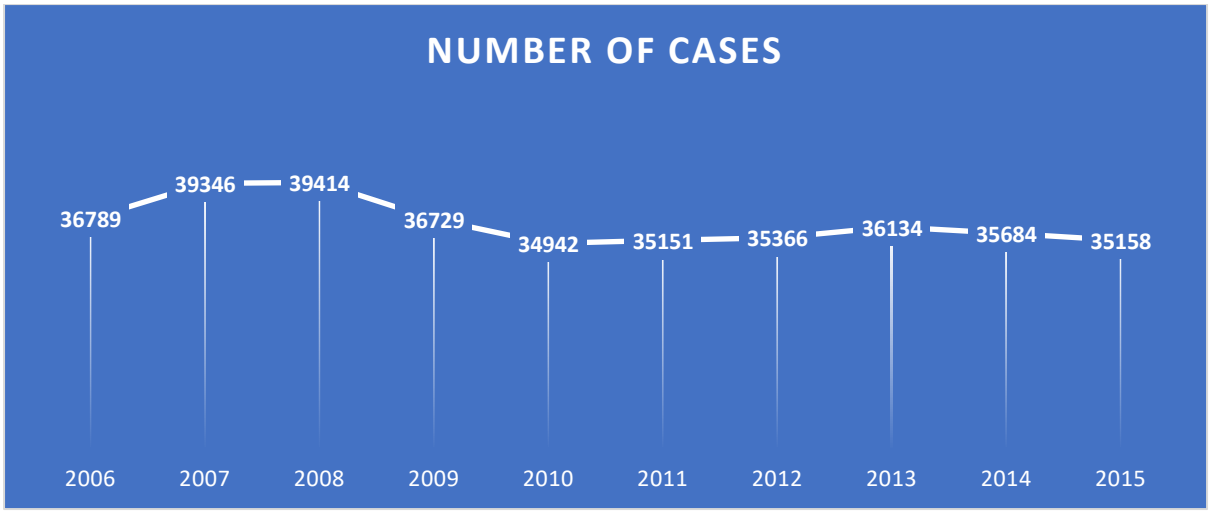
NUMBER OF CASES
36789
39346
39414
36729
34942
35151
35366
36134
35684
35158
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015

Figure. 2

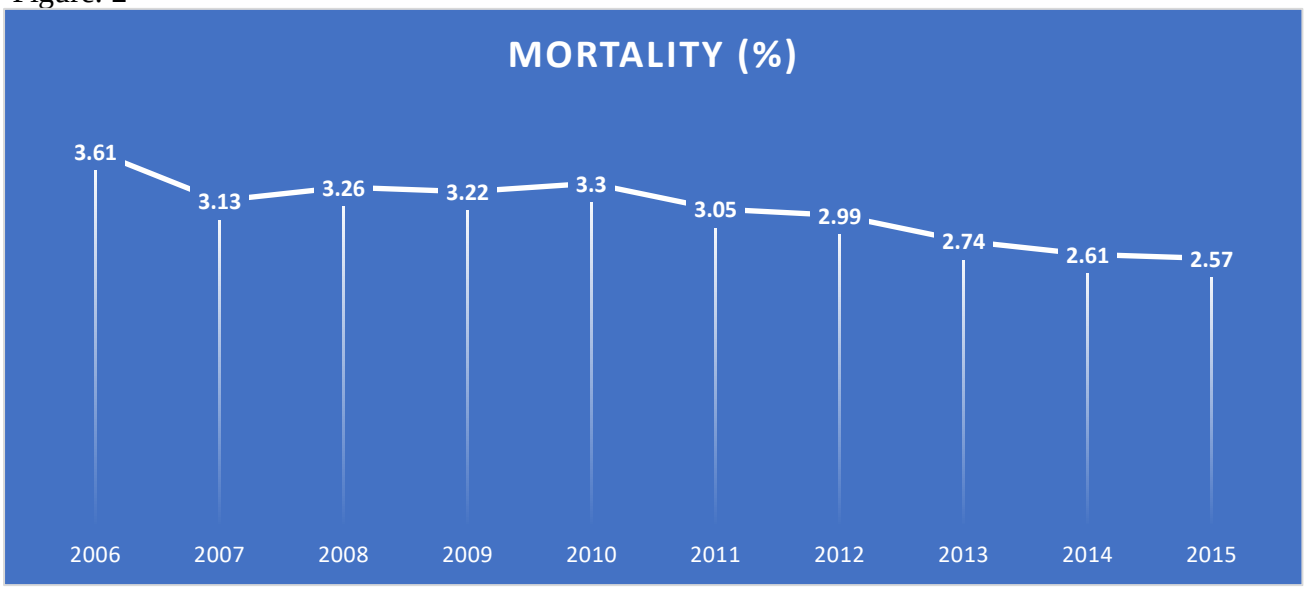
MORTALITY (%)
3.61
3.13
3.26
3.22
3.3
3.05
2.99
2.74
2.61
2.57
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015

Table. 1. Requirement of completion of cardiothoracic training

Guidelines for Cardiothoracic Surgery certification	
Clinical experience	1- Trainees should have had exposure to both adult cardiac and thoracic surgery. 2- Trainees must be able to demonstrate that they are keeping their knowledge and skills up-to-date. 3- Trainees must be able to demonstrate knowledge and understanding of the management of the following critical conditions: - Aortic dissection - Stridor - Secondary pneumothorax/tension pneumothorax - Cardiac tamponade, - Acute haemothorax, - Low cardiac output following cardiac surgery - Endocarditis-native or prosthetic valve - Respiratory failure following thoracic surgery.
Operative experience	1- There are indicative numeric requirements for the number of operations performed. This has been agreed as 250 major cases with the majority in the area of special interest. 2- Candidates should demonstrate broad exposure to operative cardiothoracic surgery with the majority of procedures in the area of special interest.
Operative competence	Trainees should demonstrate competence across a broad range of cardiothoracic procedures as evidenced by completed PBAs.
Research	1- Trainees should provide evidence of study of research methodology or possess a higher degree. 2- Trainees should have four papers

	published in peer-reviewed journals, two of which should be completed as first author. 3-Trainees should have delivered six presentations at national/international meetings, two of which must have been presented internationally. 4- Trainees should have completed a Good Clinical Practice (GCP) course in Research Governance and a research methodologies course.
Quality Improvement	Trainees should have evidence of an audit completed (loop closed) within the two years prior to certification.
Medical Education and training	Trainees should have completed courses in training and education by the time they apply for certification.
Management and leadership	Trainees should have completed courses in NHS management by the time they apply for certification.
Educational conferences	Trainees should have attended a major national or international meeting in each year of training. Training programmes require attendance at a minimum of 70% of the regional teaching days.

Table. 2. Summary of major cardiac and thoracic cases

Cardiac Major Cases
- Coronary Artery Bypass Grafting (CABG), either alone or in combination with another procedure such as valve repair/replacement - Valve repair/replacement either alone or in combination with CABG or any other cardiac procedure - Other major cardiac surgical cases involving cardiopulmonary bypass (CPB), such as post infarct ventricular septal defect (VSD) repair, excision of atrial myxoma or pericardiectomy - Implantation of the heart or lung (transplantation) - Heart-lung block retrieval - Any congenital cardiac procedure (atrial septal defect (ASD), VSD closure, patent ductus arteriosus (PDA) ligation etc)
Thoracic Major Cases
- Anatomical lung resection (VATS/robotic/open) - Correction of pectus deformity - Decortication - Thoracotomy for trauma - Chest wall resection and reconstruction - Tracheal resection - Surgery for secondary pneumothorax (VATS/open)